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THE FAUNA OF AUSTRALIA

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1. ZOOLOGICAL ISOLATION OF AUSTRALIA

The most striking character of the Australian Fauna is its distinctness from that of the rest of the world. This character is evinced as much by the peculiarity of the animals found in Australia as by the absence of others which are widely spread over the remainder of the earth's surface. In consequence of this some zoogeographers have divided the earth into two regions, Australian and non-Australian.

The land-fauna of the globe, is as a rule, limited in its migrations by the sea. Other barriers to the spread of species may be now and again overstepped, but the sea imposes restrictions that remain absolute under the existing conditions. Geology, however, teaches us that the sea has once rolled where our highest mountains stand, and that the sites of former lands are now sunk beneath the waves. Here then we find a clue to the presence on all the larger land areas of terrestrial animals. The marine barrier that now separates them is but a passing feature; they were once united and they may yet be so again, and while the union existed there was a free interchange of inhabitants.

The older a group of animals is the farther could it spread, for it has been able to make use of many land connections that have now vanished. Thus, the Felidæ and Suidæ (cats and pigs) are old enough to have found their way over almost the whole habitable globe, excepting Australia and a few islands to the north. Alone of the great islands of the world, our island-continent has remained separated from the other great land masses since the first appearance of the Felidæ and Suidæ, and so none have reached it.

Facts of a similar nature, almost numberless, may be brought forward in confirmation of this conclusion. Animals and plants alike bear evidence to its truth, and thus we see how the deficiencies of the Australian fauna are accounted for. The barrier that prevented the incursion of the adaptable and enterprising cats and pigs was equally efficient in the case of a host of other forms, from elephants to earthworms.

2. EFFECT OF ISOLATION

Before this isolation of Australia, however, some animals had reached our shores, and among them were the marsupials. Once here, they were protected by isolation from competition with the

more specialised forms that came into existence elsewhere. They varied among themselves, and gave rise to the diversified forms that now inhabit the country.

There are other groups besides the marsupials whose history runs on similar lines. Of some of them we know this history, but not of all, and the deciphering of the tale of the early origin of the fauna of Australia is one of the many interesting pieces of work that lie before the naturalist.

1 This article was contributed by T. S. Hall, Esquire, MA., D.Sc., Lecturer in Biology, Melbourne University.

3. THE NON-MARINE FAUNA

The chief interest in Australian fauna centres round the dwellers on land and in fresh water. It is they who shew the peculiarities just noticed, whereas the marine forms are more widely spread, since barriers to their migration are more easily burst through. The fauna of the Pacific Ocean differs in many points from that of the Atlantic, but is linked more or less closely with that of the Indian Ocean, so that it is usual to speak of an Indo-Pacific region. The widespread character of the marine fauna as opposed to that of the land will render it advisable, owing to limitations of space, to concentrate our attention on the latter, though we must, in consequence, pass by much that is of interest.

Mammalia

The great group of mammals has been divided into two sections, the *Prototheria* or egg laying mammals, and the *Theria*, which includes all the rest. The *Theria* are again subdivided into numerous sections, one of which is that of the marsupials. For a long while the marsupials were separated from the rest of the *Theria* on account of certain peculiarities connected with gestation. The young are born in a very undeveloped condition, and usually there is, during development, no organic connection between the foetal and maternal tissues, or in other words, no placenta is formed. However, recent research has shewn that a placenta is present in the native cat (*Dasyurus*), and as it is universally present in all *Theria* other than marsupials the criterion fails. *Dasyurus* cannot be separated from the other marsupials, so all must belong to the one group, which is called *Theria*.

The egg-laying mammals are confined to Australia, Papua and Tasmania, and there is no absolutely conclusive evidence of their ever having lived elsewhere. As regards marsupials, they are found nowadays only in Australia and some adjacent islands, and in America as far north as the Southern United States. In former times, as we know from fossils, they ranged still further north and lived even in Europe.

(a) The Higher *Theria*. In the *Theria* above the marsupials we are poorly off. The Dingo (*Canis dingo*) reached Australia while the giant mammals were still living, and his bones occur as undoubted fossils, a fact proved some forty years ago, but still not accepted by many foreign naturalists. There are several kinds of true rats (*Mus*) and a widely spread water-rat (*Hydromys chrysogaster*), as well as a few other kinds. Bats are common, for both they and rats have found their way all over the globe, excepting to a few remote islands, and this without the aid of man, and in fact before his appearance on the scene. The largest bats we have belong to the genus *Pteropus*, and are fruit-eaters, being a great scourge to orchards in the warmer parts. They are generally spoken of as flying foxes. Another large bat, a white one (*Megaderma gigas*), is found in caves far inland.

Seals, whales, and the dugong being marine forms, must be passed over.

(b) Marsupials. The group of Marsupials has, in Australia, reached its highest stage of development, and, as the other Theria are almost absent, its members have become differentiated in almost every direction to occupy their places. Thus we have the grass-eating kangaroos, the flesh-eating Tasmanian wolf and Tasmanian devil, and the "tiger cat," the insect-eating native cats and "weasels," the ant-eating marsupial mole and banded ant-eater, the root-eating wombats, the omnivorous bandicoots and leaf eating koalas. One great group of land Theria has no counterpart. There is no marsupial bat.

Marsupials have been divided into two main groups which, roughly speaking, though not exactly, correspond to carnivorous and vegetarian. This usual, but somewhat unsatisfactory, classification is founded on the teeth. An examination of the lower jaw of a wombat, kangaroo, "possum," or a few other forms, will shew that there are two strong teeth in front, the incisors. Usually only two are present. This gives the name to the group, Diprotodontia, that is, "two teeth in front." Most of its members are vegetable feeders. The other group comprises forms with several lower incisors - the Polyprotodontia, "many front teeth." These are almost entirely flesh-eaters. A more modern classification, and apparently a better one, is based on the structure of the foot. In the kangaroo, what appears to be a single toe on the inner side of the hind foot bears two claws. In reality there are two toes present which are bound together by skin. This feature is known as "syndactyly," and gives its name to the group, Syndactyla. The other group comprises the remaining marsupials, and is known as Diadactyla.

(c) Prototheria or Monotremes. The egg-laying mammals, in their strange method of reproduction, and in certain points in their structure, shew a decided approach to the reptiles, and they are widely separated in many ways from the higher mammals. They include only the platypus *Ornithorhynchus anatinus*, and the spiny-ant-eaters. The platypus is found only in Eastern Australia and Tasmania, and does not range up very far into Queensland. Its curious duck-like bill is so extraordinary that the first skins sent to Europe were viewed with suspicion. The memory of the mermaid, made up of fish and monkey skin, was too recent to be forgotten. Although the adult has no trace of teeth, strong bony teeth are present in the young, and are shed only when the animal is about half-grown. Their place is supplied by horny pads, which are quite efficient for the work they have to do. The platypus makes its nest at the end of a long burrow in a river bank, the entrance being below water-level. The eggs have no hard shell, but are soft like those of the reptile.

The spiny-ant-eaters are represented on the mainland and in Tasmania by the well-known *Tachyglossus aculeata* or *Echidna aculeata*, and in Papua by an allied form with a somewhat longer beak. The beak is narrow and rounded, and the long tongue, covered with a viscid secretion, is a very effective instrument for the capture of the ants on which the animal lives. The spines with which the body is covered are colour-banded like those of the true porcupines of the northern hemisphere, but are much shorter. When attacked the animal rolls itself into a ball. It is of great strength, burrows vertically downwards with extreme rapidity, and is an expert rock climber. The two eggs are hatched in a pouch which superficially resembles that of the marsupials. Though possessed of a pouch and "marsupial" bones, the egg-laying mammals are not, in the ordinary sense of the term, allied to the marsupials.

Diadactylous Marsupials

Confining our attention to the Australian marsupials, we find the Diadactyla, which have the second and third toes separate, are represented only by a single family, the Dasyuridæ, or native cat family. This family is apparently less changed from the original marsupial stock than is any other Australian one. The "native cats" (*Dasyurus*), the several kinds of which vary in size from that of a pug-dog to that of a ferret, are nearly all spotted with white, the body colour being brown or black. They are found all over Australia, from Tasmania to New Guinea. A number of small

species exist, ranging in size from a half-grown kitten to that of a mouse, and belonging to two other genera (*Phascogale* and *Sminthopsis*). Popularly they are called weasels and mice. Some of them are terrestrial, others arboreal. There is a peculiar jerboa-like little species (*Antechinomys laniger*), which is found throughout the drier interior. The banded ant-eater (*Myrmecobius*), about the size of a rat, has a similar range, but seems commoner on the western side of the continent. The Tasmanian Devil (*Diabolus ursinus*, or *Sarcophilus ursinus*), now confined to Tasmania, is a clumsy, hideous, black and white blotched animal, about as large as a pug-dog. Its ferocity and strength justified its name.

The last member of this family is the Tasmanian wolf or tiger (*Thylacynus cynocephalus*). It is about the size of a retriever, but with a much longer body. The cross-banded back gives it the name of tiger, which is the one generally used. It is a fierce, predatory animal, but is rapidly becoming exterminated. Like the Tasmanian Devil, it formerly lived on the mainland, and its fossil remains have been found as far north as the Darling Downs. All authorities are not agreed that the "tiger" should be included in the same family as the animals previously mentioned. Some place it in a family by itself; others group with it certain South American extinct animals known as Sparassodonts; others again hold that the latter forms are not marsupials at all, but a sort of connecting link between them and an ancient group, the Creodonta, which gave rise to the modern Carnivora, and to the Marsupialia as well.

Syndactylous Marsupials

Taking now the remaining Australian marsupials, we find that they all have the second and third toes bound together; they are *Syndactyla*. Two families are polyprotodont, namely the *Peramelidæ* and the *Notoryctidæ*; the others are diprotodont.

The *Peramelidæ*, or bandicoot family, comprises several animals mostly about the size of a large rat. They are ground-dwellers, and range over all Australia. The marsupial-mole (*Notoryctes*) forms a family by itself. It is about the size of a newly-born kitten, golden yellow in colour, quite blind, its eyes being very rudimentary and covered by the muscles of the face. On hard ground it is a clumsy, sprawling walker, but in sandy soil a remarkably rapid burrower, its great, shovel-shaped claws enabling it to sink out of sight almost at once. It has a remarkably restricted area of distribution, being confined, as far as is known, to the basin of the Finke River in Central Australia, though there is the probability that it is to be found in Western Australia.

The remaining families are diprotodont. The *Phalangeridæ* include the Australian "possums" (*Trichosurus*), which have wrongly appropriated the name of the true or American opossums. The value of the skins of these animals for farrier's purposes leads to their slaughter by millions annually, and they have now disappeared where they were once common. Some allied forms (*Petaurus*, *Dromicia* and *Acrobates*) have a fold of skin stretching from the hind to the fore-limb, which enables them to glide from a greater to a lesser height. Collectively, they are spoken of as flying-squirrels, though they cannot fly and are not squirrels. The Koala, Kola, or native bear or monkey-hear (*Phascolarctos*), a lethargic leaf-eater, belongs to this family.

The *Phascolomyidæ*, or wombat family, contains only one living genus (*Phascolomys*), which is confined to the south-east and Tasmania. The wombats are inoffensive burrowers, but unfortunately are apt to damage crops where they are common, and their great strength and burrowing powers make fences but poor protection against their inroads.

The kangaroo family (*Macropodidæ*) is a large one, and its members vary in size from the giant, standing higher than a man, to the Musk kangaroo of the Herbert River, which is about ten inches long. The larger forms were dwellers on the open plains, where, with scarcely any foes, they grazed in countless thousands. Now, like the bison of America, they are passing away. The smaller kangaroos which belong to various genera, and are spoken of as wallabies, frequent the

scrubs and rocky fastnesses of the mountains. The tree kangaroos of Queensland and New Guinea (*Dendrolagus*) browse on the leaves of lofty eucalypts, which they climb to their topmost branchlets.

Among extinct marsupials we have *Diprotodon*, as large as a rhinoceros, but as inoffensive apparently as a wombat, which it seems to have resembled much in appearance. *Thylacoleo*, a huge carnivorous monster, greater than a polar bear, was allied to the phalangers. There were also giant kangaroos, standing a dozen feet high, and wombats as large as an ox. On the other hand there was a dwarf wombat, about a quarter of the size of our recent species. The oldest known Australian marsupial, *Wynyardia* is of Oligocene or perhaps Eocene age.

Aves

Birds shew the same characteristics that the mammals do. Deficiencies, as well as the presence of peculiarly Australian forms, serve to distinguish Australia from the rest of the world. Among the groups which are eminently characteristic are the birds of paradise, which have their home in New Guinea and just pass into Northern Queensland. Of pigeons, we have more species than the rest of the world, and we have the largest and the smallest kinds. The cassowary and the emu, forming a single family, are unknown beyond our regions. The cassowary (*Casuarius*) is found in the forests of New Guinea and North Queensland, and the emu (*Dromæus*) ranges over all Australia, and, till it was exterminated, was common on Kangaroo Island, the islands of Bass-Straits, and Tasmania. The brush-tongued lorries (*Trichoglossidæ*) follow the flowering of the honey-yielding eucalypts throughout Australia. The honey-eaters (*Meliphagidæ*) are among our most characteristic birds, though they pass far beyond Australia itself, and out across the Pacific, even to the Sandwich Islands. The larger ones are sought for food, while some of the smaller kinds, which have developed a taste for orchard fruits, are at times a scourge. The peculiar mound-nests of the *Megapodidæ*, where the eggs are hatched after the manner of those of reptiles, are very characteristic of Australia, though not confined to it. Among other strange forms are the bower birds (*Ptilonorhynchidæ*), whose habit of building playing-runs and decorating them with bones, shells, flowers, and so on, has often been described. The lyre birds (*Menuridæ*) are remarkable for their peculiar tail feathers. They are inhabitants of dense fern-gullies in Eastern Australia. Their allies, the scrub birds (*Atrichidæ*) are confined to the dense forests of the warm east coast, and of West Australia. The most striking absentees, whose abundance in Eastern Asia makes their absence here so remarkable, are the pheasants and vultures, while there are other abundant East Asiatic forms which are poorly represented amongst us.

Reptilia

Among reptiles we have the estuary crocodile (*Crocodilus porosus*), occurring commonly in the northern rivers, and ranging from India to the Solomons, and even it is said, as a stray, to Fiji. A small, harmless species (*Crocodilus johnstoni*) is found in the fresh waters of the north. Of freshwater tortoises there are three genera represented (*Chelodina*, *Emydura* and *Elseya*). None occur in Tasmania. These tortoises tuck their heads into their carapaces by an S-shaped fold in a horizontal plane, and belong to a group whose other representatives are found in South America.

Among lizards the most peculiar are the so-called legless lizards (*Pygopodidæ*), which are confined to Australia. In them the front limbs are completely absent, and the hind limbs are represented only by a pair of short flaps, which fit into grooves at the side of the body, and so easily escape detection. The family contains seven genera, *Pygopus*, *Delma*, and *Lialis* being the most widely spread. The skinks (*Scincidæ*) are the most numerous Australian family, and the *Varanidæ*, commonly called "goannas," contain the largest of our lizards. Altogether we have about 390 species of lizards.

There are slightly more than 100 species of Australian snakes, about three-quarters of them being venomous. The number of non-poisonous forms decreases as the latitude rises, so that in Tasmania none are found, all the snakes being venomous. The harmless kinds include the blind snakes (Typhlopidae), which have very smooth, glassy skins, and are burrowing forms, living principally on termites, and therefore deserving of careful protection. The pythons and rock snakes are the largest of our Ophidia, but are also harmless. *Python spilotes*, the diamond and carpet snake of the mainland, is beautifully mottled. It grows to a length of about 10 feet, and is found throughout Australia. The long, slender, green tree-snake (*Dendrophis punctulatus*) inhabits almost the whole of Australia. It is quite harmless and feeds on tree frogs, young birds, and lizards. Though so many of our snakes are poisonous, only five common forms are really deadly. These are the brown snake (*Diemenia textilis*, or *Demansia textilis*), the black snake (*Pseudochrys porphyriacus*), the copperhead--unfortunately called diamond snake in Tasmania--(*Denisonia superba*), the tiger snake (*Notechis scutatus*), known in Tasmania as the carpet snake, and lastly the death adder (*Acanthophis antarctica*). The first four all occur in Tasmania, and are the only snakes found there. The tiger snake is the boldest of all, and commonly shews fight. The death adder, a short, thick-bodied snake, is very lethargic, and often allows itself to be trodden on, when it strikes with lightning-like rapidity and deadly effect. None of our snakes have long enough teeth to make their bite, when made through clothing - even a single thickness of tweed - a cause of dread.

Amphibia

In amphibia the most striking fact is the absence of tailed forms (Urodela). The characteristic old world genus *Rana* just invades North Queensland. We are especially rich in tree frogs (Hylidae), some of which as *Hyla aurea*, the common southern green frog, have lost their tree-climbing habits and the adhesive suckers on fingers and toes. The Cystignathidae, which include the common sand frog of the south east, occur also in South America. The water-holding frog, with its body enormously distended by water, can live for a year or more in thoroughly dried mud. It is found in Central Australia.

Pisces

Owing to our poor river development, Australia is not rich in fresh water fish. The great river basin of the Murray has several species peculiar to itself, as the Murray cod (*Oligorus macquariensis*), the golden perch (*Plectroplites ambiguus*), the silver perch (*Therapon ellipticus*) and the catfish (*Copidoglanis tandanus*). Of these, the Murray cod, owing to stream capture and the consequent alteration of drainage areas, has invaded the head waters of a few other rivers, as the Richmond and Clarence Rivers in New South Wales. Another curious instance of distribution is that of the blackfish of the south-east (*Gadopsis marmoratus*). This is almost confined to rivers entering Bass Straits, it being found in Northern Tasmania and Southern Victoria. These streams are the now separated upper-waters of a river which drained the plain now occupied by Bass Strait, and entered the ocean to the north of King Island. River capture has carried blackfish into the upper waters of the Goulburn and the Loddon. Eels, which are common in all streams from Cape York to Beachport, are absent from the entire Murray basin and Central and Western Australia, and apparently from Northern Australia as well. The southern trouts (*Galaxias*) are found in the streams of south-eastern Australia and Tasmania. Elsewhere they are found in South Africa, New Zealand, Patagonia and Chile. As some of the species, but not all, breed in the sea, the distribution of the genus is not as remarkable as once was thought. The gudgeons or bullheads (Gobiidae) have representatives in fresh water all over Australia. None of these grow to any size.

The most remarkable of all our fresh-water fish, however, is the Lung fish (*Neoceratodus forsteri*) of the Mary and Burnett Rivers of Queensland. It is one of the three surviving species of an

ancient and once world-wide group of fish. As its name implies, it has a lung, a modified swim-bladder, in addition to the usual gills. When the water is foul it comes to the surface to breathe. It cannot, as its African relatives do, live in the mud of dried-up ponds.

Invertebrate Fauna

In land and fresh-water shellfish we are not well off. The eastern coastal strip from Cape York well into New South Wales is closely related to Papua in its shellfish, as it is also in so many other ways. There are many genera of the *Helices*. Of the rest of Australia the western State seems the poorest in molluscs, though many of its inhabitants range right across to the eastern highlands.

Among insects, the butterflies of the warm damp Queensland coastal districts vie in beauty with those of any part of the world. As we retire from this region their number and size decrease. The wandering butterfly, a black and white species, at times appears in countless myriads and travels far out to sea. We are especially rich in beetles of the families *Buprestidæ*, *Curculionidæ*, and *Cerambycidæ*, the members of the first family containing some very handsome insects. White ants are plentiful, especially in the tropics. One species is remarkable for its narrow, wall-like nests, which have their long axes along the north and south line.

Among crustacea a species of *Apus* is found in the interior, and the allied *Lepidurus* in the southern coastal districts. The peculiar isopod, *Phreatoicus*, and some allied genera, are found in our mountain streams or burrowing in the damp southern gullies. *Koonunga*, a recently described *Anaspid*, is an annectant form between the stalk-and sessile-eyed groups. Among the higher crustacea belonging to the *Parastacidæ* are the genera *Astacopsis* (*Chærops*), which is spread all over the continent, and *Engaeus*, found only in Tasmania and Southern Victoria. The larger species of *Astacopsis* are used as food.

Among the flat-worms, *Linstowia* is peculiar, as it is confined to the monotremes and the marsupials of Australia and South America. The genus then must date back to Mesozoic times. *Temnocephala* infests the fresh-water crayfish, and is curious on account of its distribution, as it ranges up into America, and, strange to say, an allied form has recently been recorded from Southern Europe.

Australia is rich in earthworms, but the native species are being ousted by European forms. *Megascolides* is remarkable for the size of one of its species, the giant earth worm of Gippsland (*M. australis*), which reaches a length of over seven feet, and is as thick as a man's finger. The *Acanthodrilidæ* are distinctly a southern family, being especially plentiful in Australia, New Zealand and South America, and gradually becoming fewer in species as we pass north from these lands.

To attempt to deal with the fresh-water protozoa would make too great demands on space, and for the same reason the whole of the marine fauna must here be passed over in silence.

4. ORIGIN OF THE FAUNA

The place of origin of our Fauna and its route into Australia has been much discussed. As mentioned previously, it consists of several constituents. The marsupials, and probably some of the birds, the tortoises, the cystignathid frogs, some fresh-water fish (as the *Galaxiidæ* and some others), many insects and earthworms, have their nearest living allies in South America. These represent ancient groups, and probably date back to the times when a great antarctic continent existed, of which the southern lands are but isolated fragments.

Much of the remaining Fauna has a northern origin, as the dingo, rats, bats, most of our flying birds, lizards, fresh-water crayfish, and probably the bulk of our insects. The evidence of a Malayan incursion, both of plants and animals, is specially strong along the damp seaward slopes of the eastern coast range of Australia.

The native Australian Fauna is in danger of disappearing before the inroads of introduced animals like the rabbit, the sparrow, and the starling. The beginning of an attempt to stay this onset may be seen in the reservation in some of the States of asylums for the native animals. The Victorian reserve includes nearly all Wilson's Promontory, the southernmost part of Australia; New South Wales has reserved a coastal strip near the Hawkesbury mouth; but enlightened action is badly needed.

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